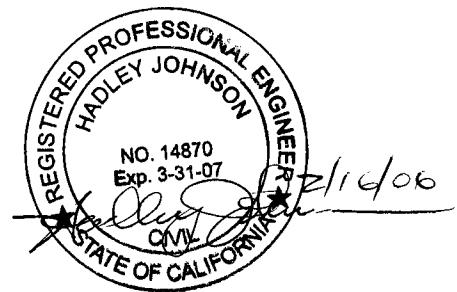


**HUKARI
PRELIMINARY DRAINAGE STUDY
TPM 20830
LOG NO. 04-02-017
APN 125-133-01
Revised 12/28/05
Revised 2/14/06**



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DEPARTMENT OF PLANNING

**PRELIMINARY DRAINAGE STUDY
TPM 20830**

This project will not affect the impact on the quantity and pattern of runoff of the surrounding area. In addition, siltation and erosion should not be an issue.

The reason for the above statement is the access road (Mountain View Rd) is existing paved a minimum width with asphalt concrete of 20 ft. & culverts are existing within the existing drainage swales. In addition, the onsite grove roads have been paved with asphalt concrete and in most cases will be used as driveway access to each home site. The exception is parcel no. 3 with a short 250 ft. driveway. B.M.P. will be used to control erosion and siltation.

The preliminary grading plan (attached) shows the drainage pattern from each of the proposed pad. The flow from each of the discharge points will be less than 1 cfs and will be directed to existing driveway and or grass swale areas and rip rap to reduce flow velocity.

As previously stated, the project has been developed with paved grove road and is mostly planted to avocados. The proposed project would not disrupt drainage or cause off-site flooding.

The potential impacts will be siltation from widening of the grove road to meet private road standards and grading of the proposed pads. The mitigation measures will be best management practice (BMP) to contain siltation with silt fence, gravel bag, construction entrances, hydroseed and or bonded fiber matrix for exposed soil. Rip rap will be placed at all points of discharge to reduce flow velocity.

Prepared by:

Hadley Johnson
RCE 14870

HUKARI
PRELIMINARY DRAINAGE STUDY
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LOG NO. 04-02-017
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TOTAL AREA MAIN DRAINAGE SWALE

A = 140 ACS.

SOIL GROUP ½ B, ¼ C, ¼ D

WATERSHED L = 3200 FT.

WATERSHED H = 374

$$C_{AVG} = 0.5(0.32) + (0.25)(0.36) + (0.25)(0.41)$$

$$C = 0.16 + 0.09 + 10$$

$$\text{AVERAGE } S = 11.7\%$$

$$C = 0.35$$

$$T_c = 8.5 + 6.4$$

$$Q = C.I.A.$$

$$T_c = 14.9 \text{ MINS.}$$

$$Q_{10} = 0.35(3.0)(140)$$

$$I_{10} = 3.0 \text{ IN/HR}$$

$$Q_{10} = 147 \text{ cfs}$$

$$I_{100} = 4.8 \text{ IN/HR}$$

$$Q_{100} = 0.35(4.8)(140)$$

$$Q_{100} = 235 \text{ cfs}$$

EXISTING SWALE 7% S ½ = 0.26

ASSUME CHANNEL 30 FT. WIDE 3' DEEP

$$A = \frac{1}{2}bh = \frac{1}{2}(30)(3) = 45 \text{ SQ. FT.}$$

$$wp = 31$$

$$Q = \frac{1.486}{0.075} (45)(1.28)(0.26) = 296 \text{ cfs}$$

$$r = 45/31 = 1.45$$

$$r = 2/3 = 1.28$$

EXCEED 235 cfs ∴ OK

NORTHERLY CULVERT UNDER MT. VIEW

AREA = 140 ACS - 42 ACS - 23 ACS = 75 ACS.

A = 75 ACRES

WATERSHED L = 2350 FT.

WATERSHED H = 314

$$T_c = 6 + 6.4$$

$$T_c = 12.4 \text{ MINS.}$$

$$Q_{10} = 0.35(3.5)(75)$$

$$I_{10} = 3.5 \text{ IN/HR}$$

$$Q_{10} = 92 \text{ cfs}$$

$$I_{100} = 5.2 \text{ IN/HR}$$

$$Q_{100} = 0.35(5.2)(75)$$

$$Q_{100} = 136.5 \text{ cfs}$$

HW = 2 WITH HEADWALL

D

USE 48" CAPACITY = 150 cfs

EXCEEDS 136.5 ∴ OK

SOUTHERLY CULVERT UNDER MT. VIEW

A = 42 ACRES

WATERSHED L = 1800 FT.
WATERSHED H = 270

Q = C.I.A.

Tc = 5 + 6.4
Tc = 11.4 MINS.
I₁₀ = 3.6 IN/HR
I₁₀₀ = 5.5 IN/HR

Q₁₀ = 0.35(3.6)(42)
Q₁₀ = 52.9 cfs
Q₁₀₀ = 0.35(5.5)(42)
Q₁₀₀ = 80 cfs

HW = 2.4 WITH HEADWALL

D

USE 36" CULVERT CAPACITY = 80 ∴ OK

S = 9%

ASSUME CHANNEL 20 FT. WIDE 2' DEEP

A = $\frac{1}{2}bh$ = 20

$$Q = \frac{1.486}{0.075} (20)(1)(0.3) \quad Q = 118 \text{ cfs}$$

EXCEED 80 cfs ∴ OK

PREPARED BY:

Hadley Johnson
RCE 14870
11/29/2004

**On Site
Preliminary Drainage Study**

Area No. 1 Northerly 3 acres

Drainage from this area will be sheet flow across 800 ft. +/- of the northwesterly property line.
Approximately 0.4 acs of the 3 acre area will be impacted by development.

**Pre Construction
Soil Group C**

$$C = 0.36$$

$$\begin{aligned} Q_{10} &= 0.36(4.8)(3) \\ Q_{10} &= 5.2 \text{ cfs} \\ Q_{100} &= 0.36(7)(3) \\ Q_{100} &= 7.6 \text{ cfs} \end{aligned}$$

$$\begin{aligned} \text{Watershed L} &= 200 \text{ ft.} \\ \text{Watershed H} &= 50 \text{ ft.} \end{aligned}$$

$$T_c = 1 + 6.4 + 7.4$$

$$\begin{aligned} I_{10} &= 4.8 \text{ in/hr} \\ I_{100} &= 7.0 \text{ in/hr} \end{aligned}$$

$$\begin{aligned} \text{Post Construction} \\ \text{Soil Group C} \\ 2.6 \text{ acs} &= 0.36 \quad 0.4 \text{ ac} = 0.78 \\ C_R &= \frac{2.6(.36) + 0.4 (.78)}{3} \\ C_R &= 0.416 \end{aligned}$$

$$\begin{aligned} Q_{10} &= 0.416(4.8)(3) \\ Q_{10} &= 6 \text{ cfs} \end{aligned}$$

Change in flow

$$\begin{aligned} Q_{10} &= 0.8 \text{ cfs } 15.4\% \\ Q_{100} &= 1.1 \text{ cfs } 14.5\% \end{aligned}$$

$$\begin{aligned} Q_{100} &= 0.416(7.0)(3) \\ Q_{100} &= 8.7 \text{ cfs} \end{aligned}$$

Increase flows will be mitigated onsite by grass swales

Area No. 2 Area = 7 acres

Soil Group C

$$C = 0.36$$

$$\begin{aligned} \text{Watershed L} &= 850 \text{ ft.} \\ \text{Watershed H} &= 152 \text{ ft.} \\ S &= 17\% \end{aligned}$$

$$T_c = 3 + 6.4 + 9.4$$

Pre Construction

$$\begin{aligned} Q_{10} &= 0.36(4.0)(2) \\ Q_{10} &= 10 \text{ cfs} \\ Q_{100} &= 0.36(6.2)(7) \\ Q_{100} &= 15.6 \text{ cfs} \end{aligned}$$

$$\begin{aligned} I_{10} &= 4.0 \text{ in/hr} \\ I_{100} &= 6.2 \text{ in/hr} \end{aligned}$$

Post Construction

0.5 acs developed

$$C_R = \frac{0.36(6.5) + 0.78(0.5)}{7}$$

$$C_R = 0.39$$

Change in flow

$$Q_{10} = 0.396(4.0)(7)$$

$$Q_{10} = 10.9$$

$$Q_{10} = 0.9 \text{ cfs } 9\%$$

$$Q_{10} = 1.3 \text{ cfs } 8\%$$

$$Q_{100} = 0.39(6.2)(7)$$

$$Q_{100} = 16.9 \text{ cfs}$$

Increase flows will be mitigated by onsite by grass swales

Area No. 3 Area = 7 acres

Soil Group C

Watershed L = 900 ft.

Watershed H = 160 ft.

S = 17%

$$C = 0.36$$

$$Tc = 3 + 6.4 + 9.4$$

Pre Construction

$$Q_{10} = 0.36(4.0)(7)$$

$$Q_{10} = 10 \text{ cfs}$$

$$Q_{100} = 0.36(6.2)(7)$$

$$Q_{100} = 15.6 \text{ cfs}$$

$$I_{10} = 4.0 \text{ in/hr}$$

$$I_{100} = 6.2 \text{ in/hr}$$

Post Construction

Area developed 1 ac

$$C_R = \frac{0.36(6.5) + 0.78(1)}{7}$$

$$C_R = 0.42$$

$$Q_{10} = 0.426(4)(7)$$

$$Q_{10} = 11.8 \text{ cfs}$$

$$Q_{100} = 0.42(6.2)(7)$$

$$Q_{100} = 18.2 \text{ cfs}$$

Increase flow

$$Q_{10} = 1.8 \text{ cfs } 18\%$$

$$Q_{100} = 2.6 \text{ cfs } 16.6\%$$

Increase flows will be mitigated by onsite by grass swales

Area No. 4 7 acres on site 9 acs off site Total 16 acs.

Soil Group C

Watershed L = 1500 ft.
Watershed H = 189 ft.
S = 12.6%

C = 0.36

Tc = 5.4 + 6.4 = 11.8

Pre Construction

$$Q_{10} = 0.36(3.5)(16)$$

$$Q_{10} = 20.2 \text{ cfs}$$

$$Q_{100} = 0.36(5.3)(16)$$

$$Q_{100} = 30.5 \text{ cfs}$$

$$I_{10} = 3.5 \text{ in/hr}$$

$$I_{100} = 5.3 \text{ in/hr}$$

Post Construction

Area developed 0.85 ac

$$C_R = \frac{15.15(.36) + 0.85 (0.78)}{16}$$

$$C_R = 0.38$$

$$Q_{10} = 0.386(3.5)(16)$$

$$Q_{10} = 21.2 \text{ cfs}$$

$$Q_{100} = 0.38(5.3)(16)$$

$$Q_{100} = 32.2 \text{ cfs}$$

Increase flow

$$Q_{10} = 1.0 \text{ cfs } 5\%$$

$$Q_{100} = 1.7 \text{ cfs } 5.6\%$$

Increase flows will be mitigated by onsite by grass swales

TPM 20830
LOG NO. 04-02-017
TABLE PRE-DEVELOPMENT vs. POST DEVELOPMENT
100 YR. FLOW

<u>AREA NO.</u>	<u>PRE-DEV. FLOW</u>	<u>POST DEV. FLOW</u>	<u>CHANGE</u>
#1-3 ACS	7.6 cfs	8.7 cfs	1.1 cfs
#2-7 ACS	15.6 cfs	16.9 cfs	1.3 cfs
#3-7 ACS	15.6 cfs	18.2 cfs	2.6 cfs
#4-7 ACS (ONSITE) 9 ACS (OFFSITE)	30.5 cfs	32.2 cfs	1.7 cfs

Increase flows mitigated by grass swales

ONSITE FLOW

AREA NO. 3

ABOVE CUL-DE-SAC

Area = 3 Acs.

Watershed L = 450 ft.
Watershed H = 80 ft.

Soil Group "C"

S = 17%

CR = 0.42

Tc = 2 + 6.4 = 8.4

Q10 = 0.42(4.2)(3)

I10 = 4.2 in/hr

Q10 = 5.29 cfs

I100 = 6.8 in/hr

Q100 = 0.42(6.8)(3)

Q100 = 8.6 cfs

Capacity 18" culvert

Q = 10 cfs $\frac{HW}{D} = 1.5$

Exceed 8.6 cfs ∴ OK

AREA 4

ABOVE DRIVEWAY TO PARCEL 4 AND ACCESS ROAD

Area= 12 acs

Watershed L = 1200 ft.
Watershed H = 144 ft.

Soil Group "C"

S = 12%

CR = 0.38

Tc = 4 + 6.4 = 10.4

Q10 = 0.38(3.8)(12)

I10 = 3.8 in/hr

Q10 = 17.3 cfs

I100 = 5.8 in/hr

Q100 = 0.38(5.8)(12)

Q100 = 26.4 cfs

Capacity 24" culvert

$\frac{HW}{D} = 2$

D

= 26.4 cfs ∴ OK

Prepared by:
Hadley Johnson
RCE 14870
2/14/2006

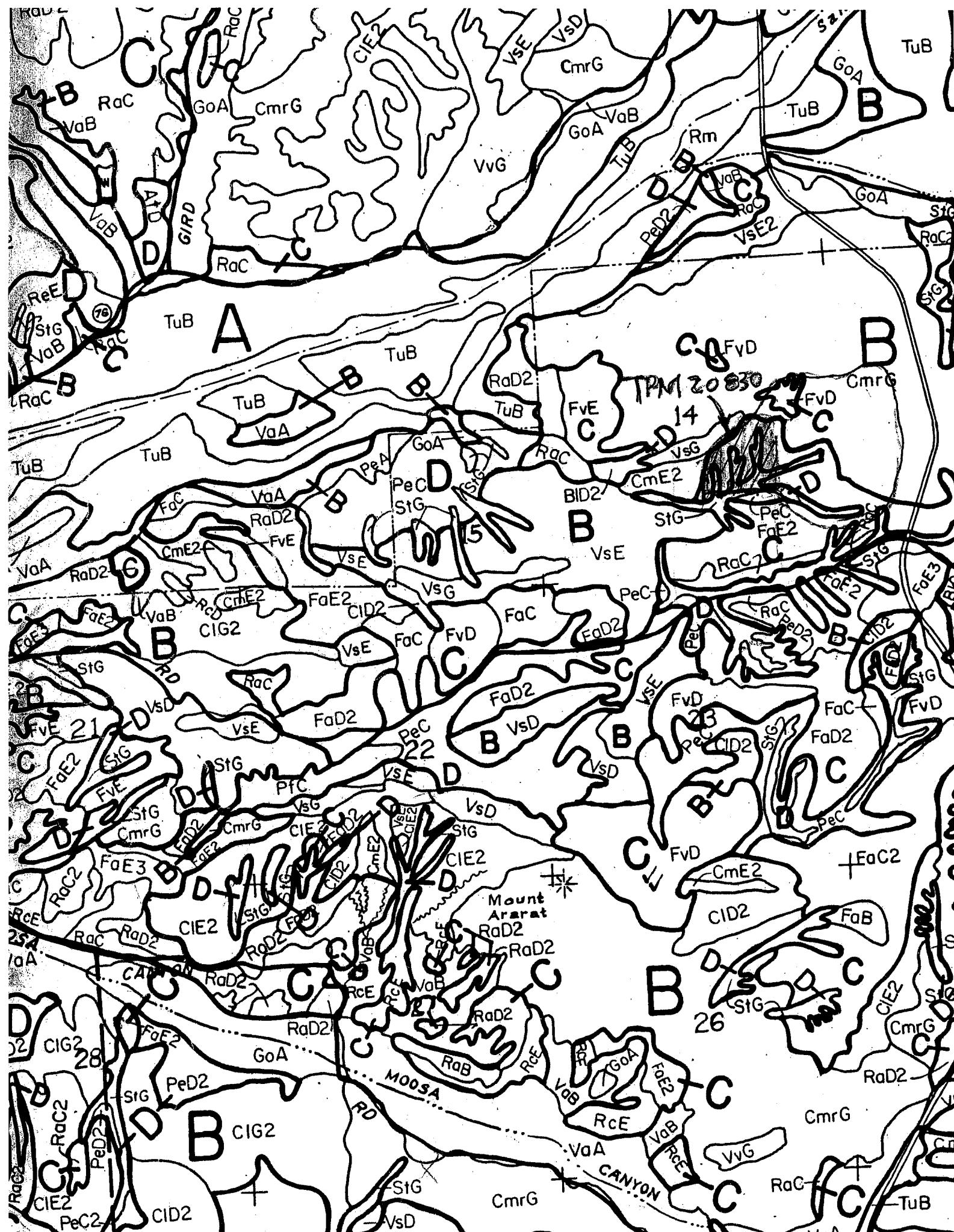
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

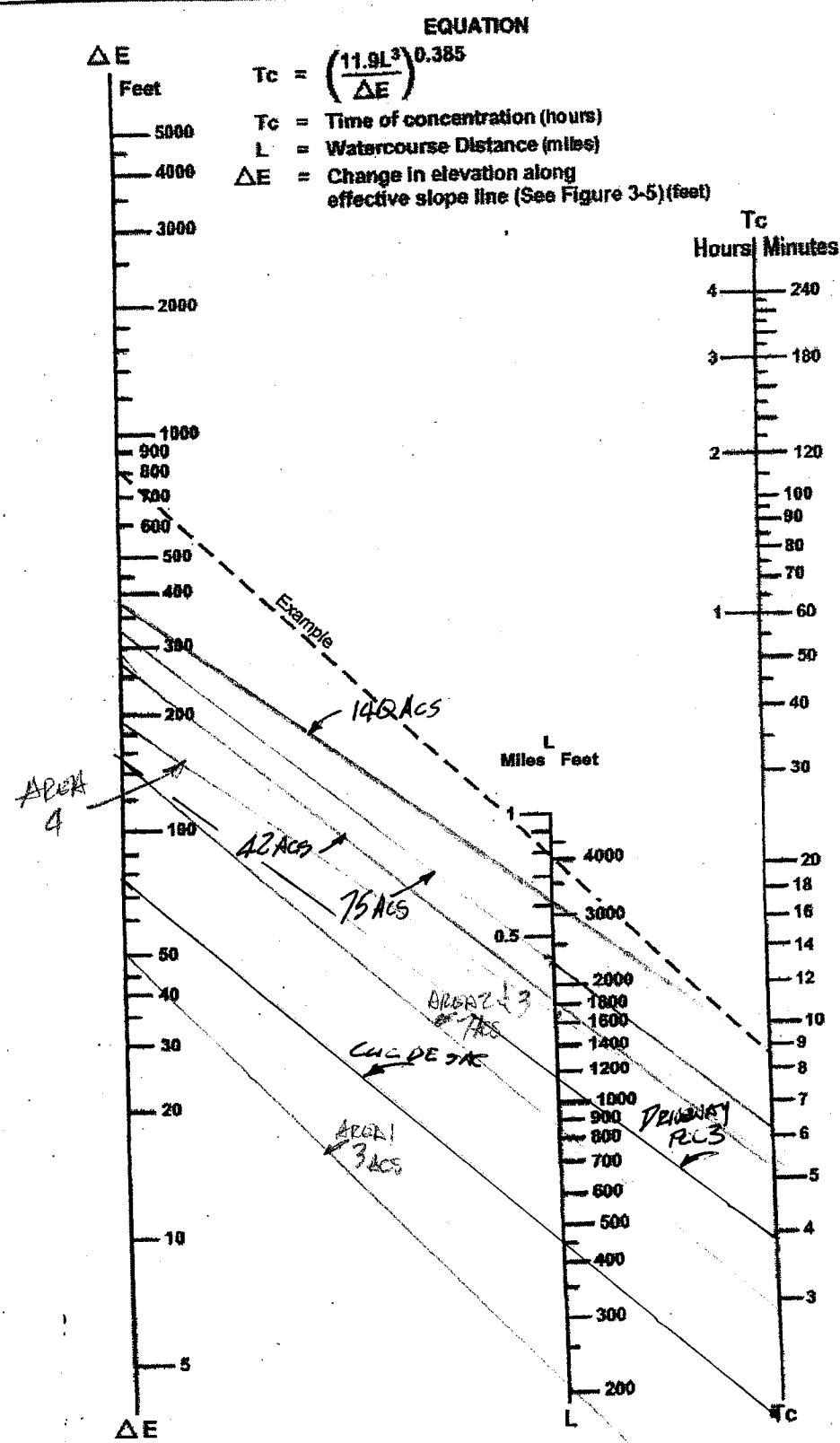
NRCS Elements	Land Use	County Elements	Runoff Coefficient "C"			
			% IMPER.	A	B	C
			D	D	D	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DUA or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DUA or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DUA or less	25	0.38	0.41	0.45	0.49
Low Density Residential (LDR)	Residential, 4.3 DUA or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DUA or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DUA or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DUA or less	50	0.55	0.58	0.60	0.63
Medium Density Residential (MDR)	Residential, 24.0 DUA or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DUA or less	80	0.76	0.77	0.78	0.79
High Density Residential (HDR)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (G. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (O.P. Com)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the previous runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DUA = dwelling units per acre

NRCS = National Resources Conservation Service





SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Nomograph for Determination of
Time of Concentration (T_c) or Travel Time (T_t) for Natural Watersheds

3-4

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

**MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)**

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i										
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

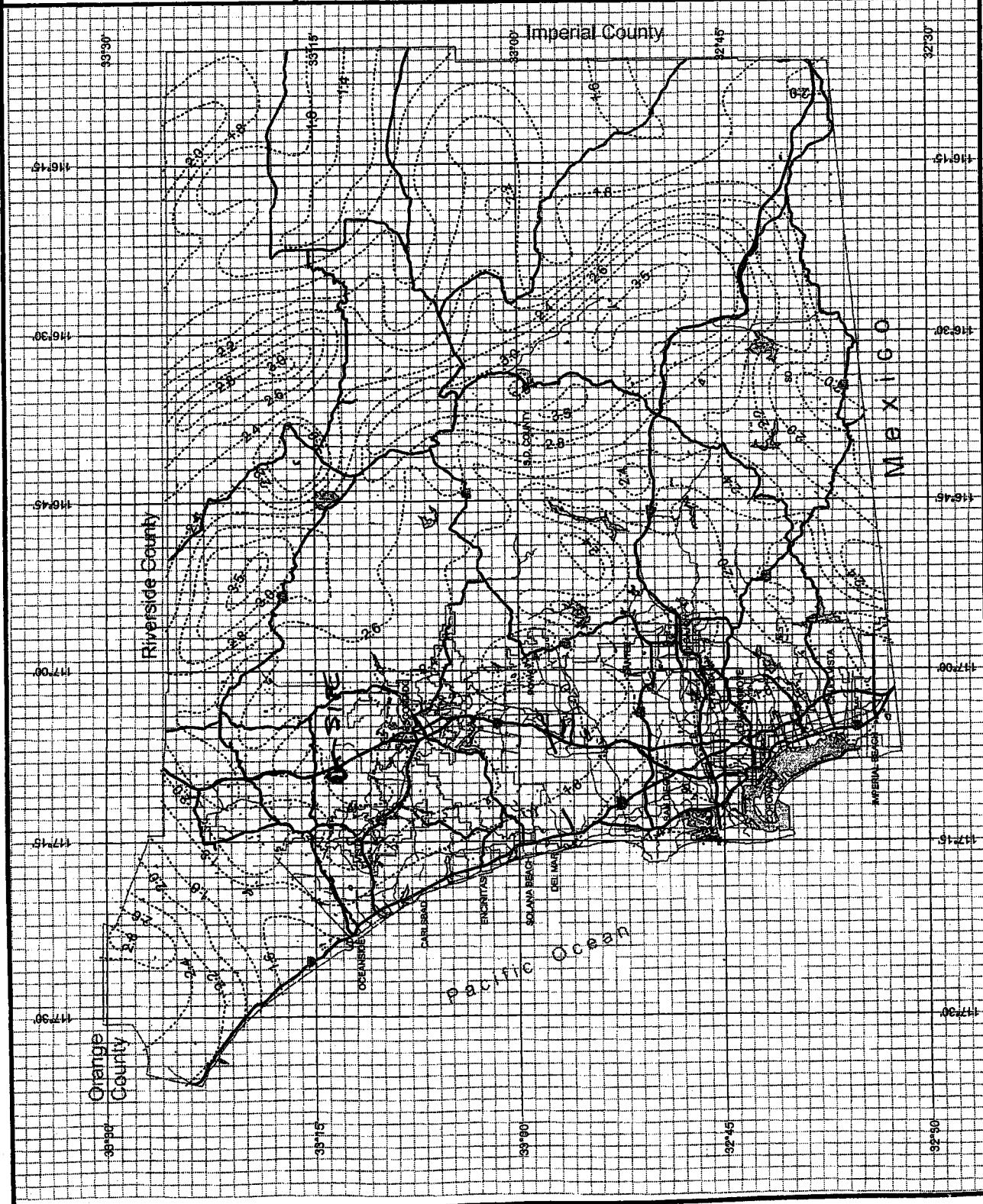
County of San Diego Hydrology Manual



Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (Inches)



County of San Diego
Hydrology Manual



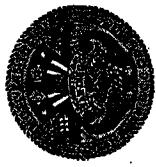
Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

..... Isopluvial (Inches)



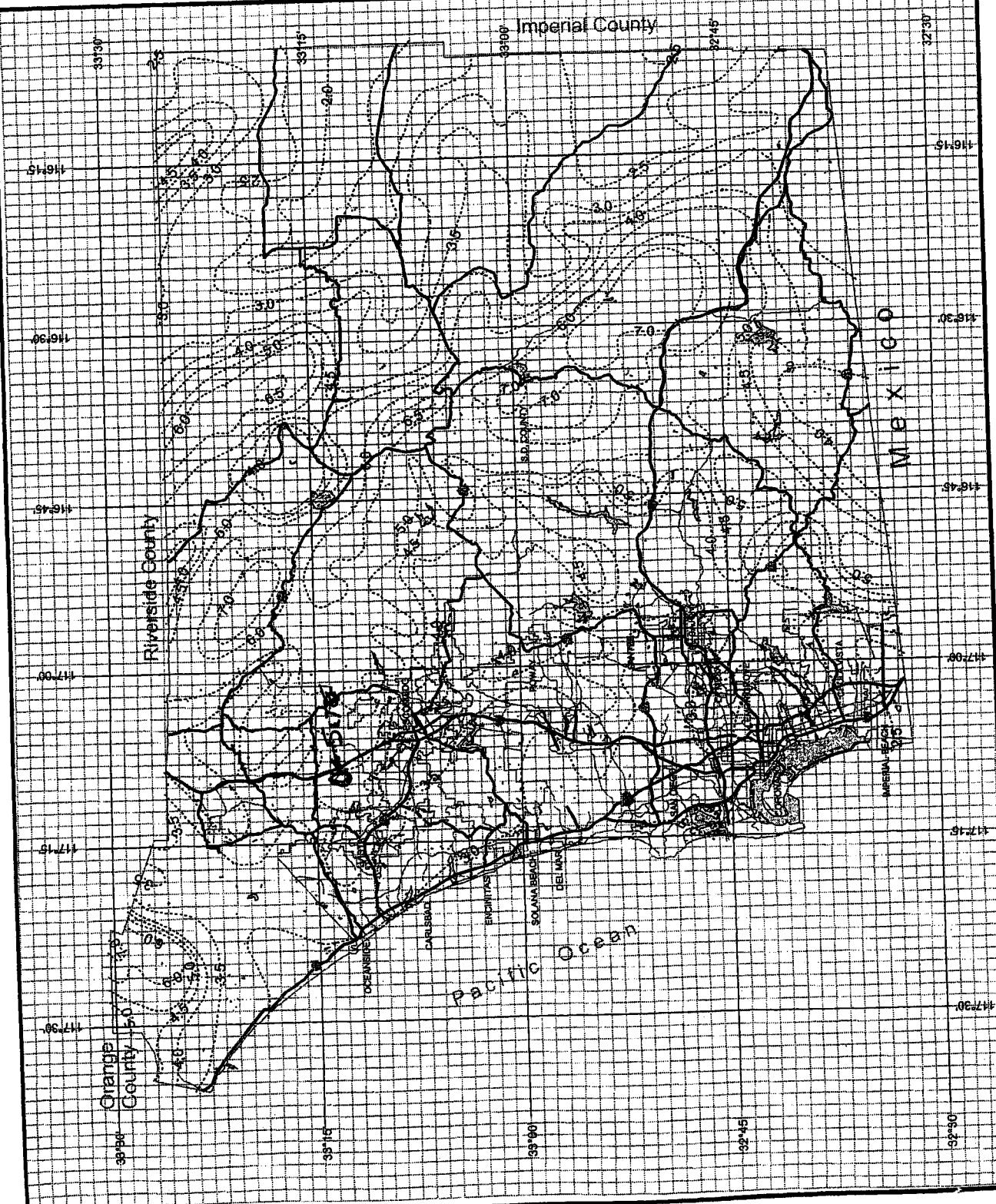
County of San Diego Hydrology Manual



Rainfall Isophivials

10 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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County of San Diego
Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (Inches)



Directions for Application:

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the Intensity-duration curve for the location being analyzed.

Application Form:

10/100 year

(a) Selected frequency $P_6 = \frac{P_{24}}{7.0} = \frac{53}{7.0} = 7.6$

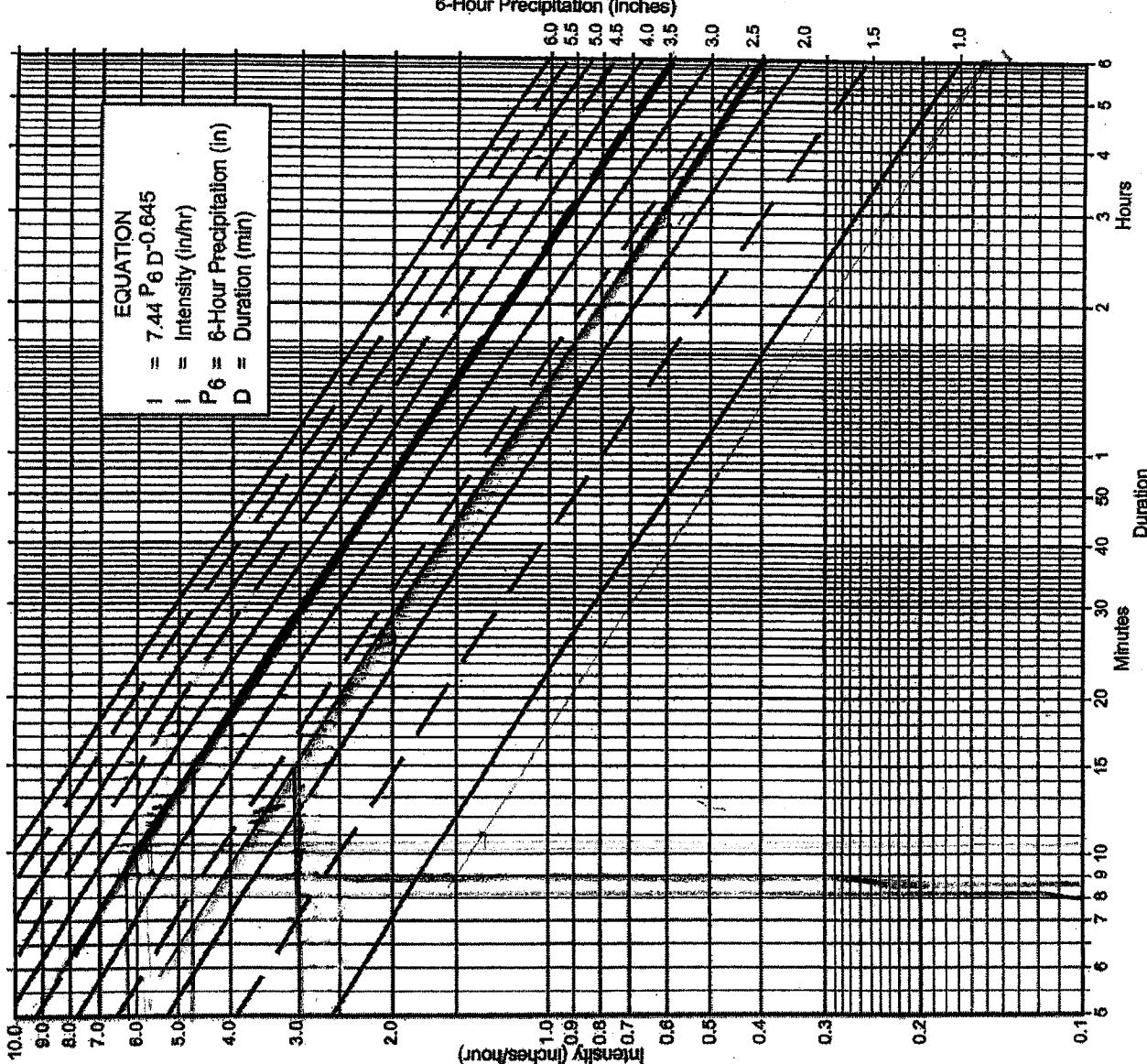
(b) $P_6 = \frac{24}{7.0} \text{ in. } P_{24} = \frac{4.3}{7.0} \frac{P_6}{P_{24}} = \frac{53}{30} \text{ in.}$

(c) Adjusted $P_6^{(2)} = 2.4 \frac{7.6}{7.0} \text{ in.}$

(d) $t_X = 14.2 \text{ min.}$

(e) $I = \underline{\hspace{2cm}} \text{ in./hr.}$

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.



FIGURE

3-1

Intensity-Duration Design Chart - Template

